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Chadwick

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(54) **CREEL MAGAZINE SUPPLY SYSTEM AND METHOD**

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B65H 49/00 (2006.01)
D02H 1/00 (2006.01)

(52) **U.S. Cl.** ..... **242/560**; 242/131; 28/193; 66/125 R

(58) **Field of Classification Search** ..... 242/551, 242/557, 558, 559, 559.3, 560, 588, 590, 242/593, 594, 594.6, 597, 597.8, 131, 131.1; 139/246–252; 414/222.01, 267, 331; 66/125 R, 66/125 A, 168; 28/190, 193
See application file for complete search history.

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(57) **ABSTRACT**

A creel magazine for delivering packaged stranded material to a creel. The magazine includes magazine frame having guides for directing stranded materials to a creel or manufacturing process. Movable magazine cartridges rotatably support packages of stranded materials and are positioned on either side of the magazine frame. The apparatus and method provide for sequential delivery of stranded materials by alternating delivery sources between cartridges, intermediate replenishment of spent packages by rotation of a full package to a delivery position, and replenishment of spent cartridges.

27 Claims, 10 Drawing Sheets

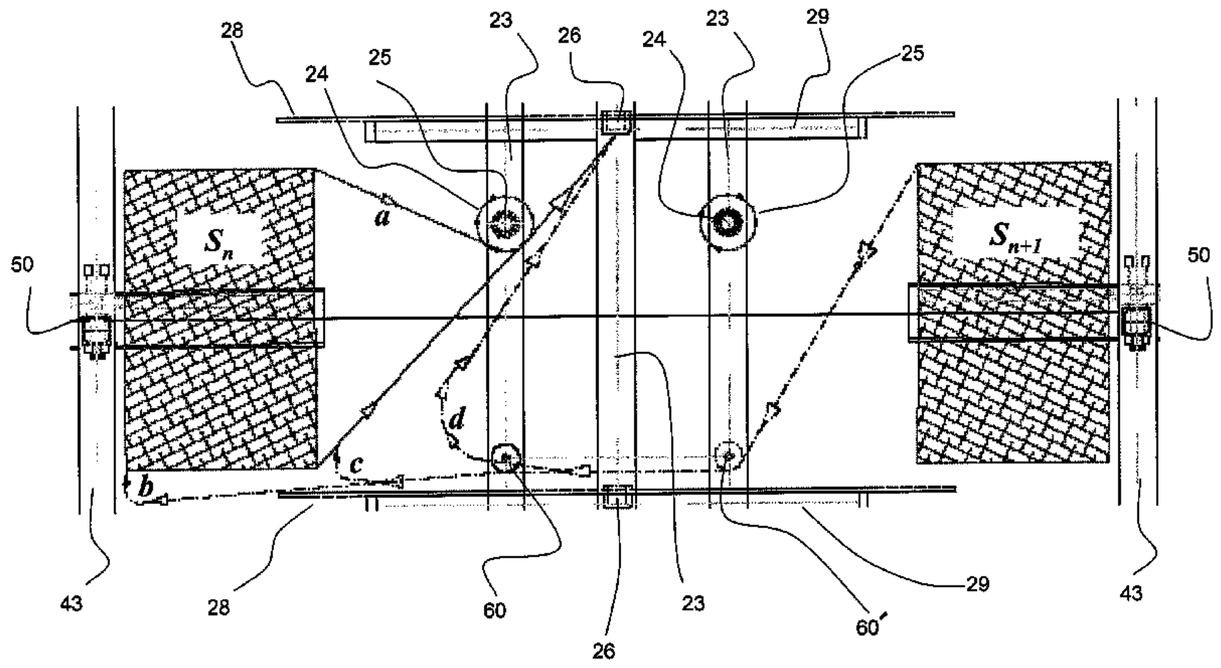

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FIG. 1

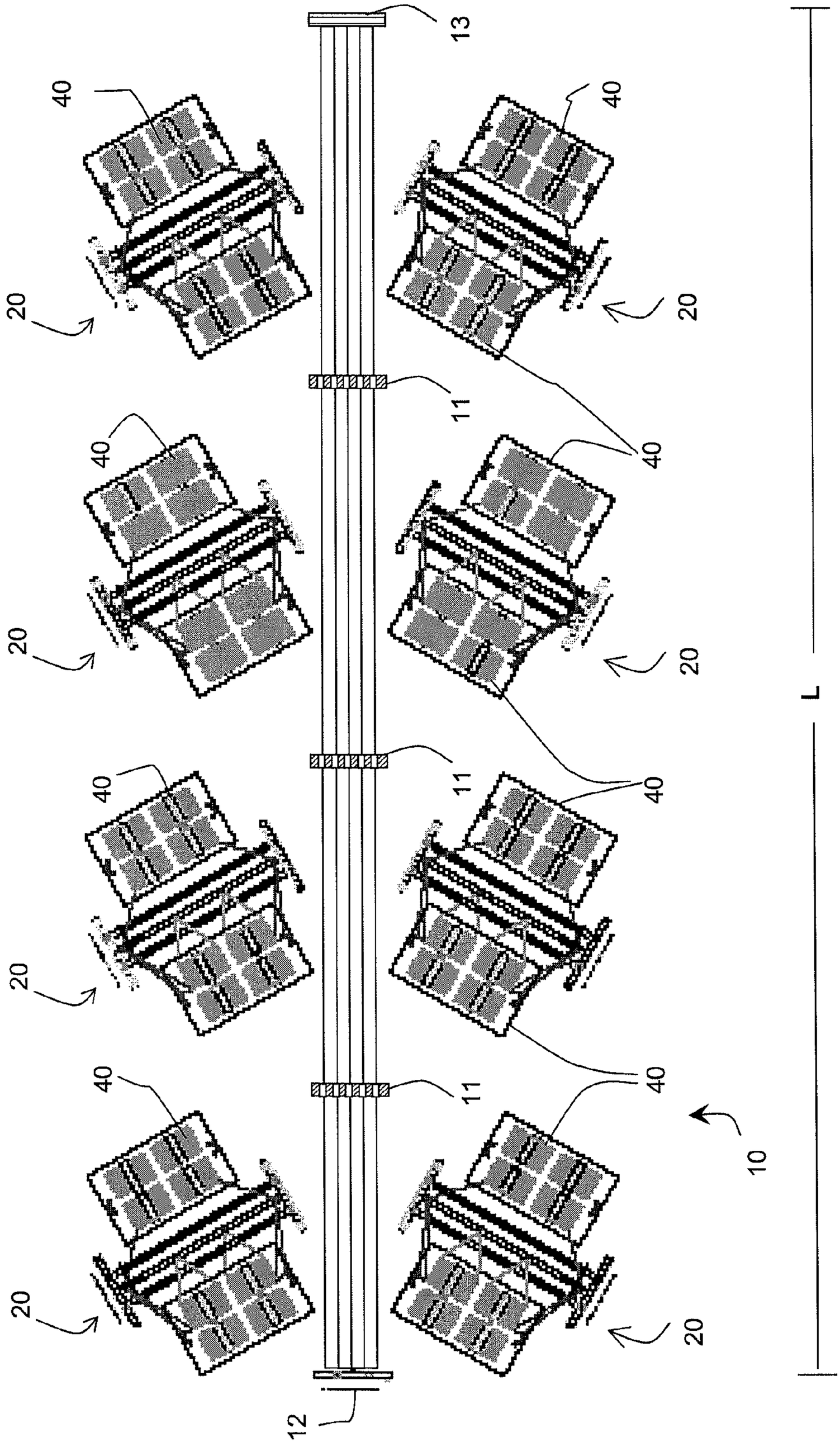


FIG. 2

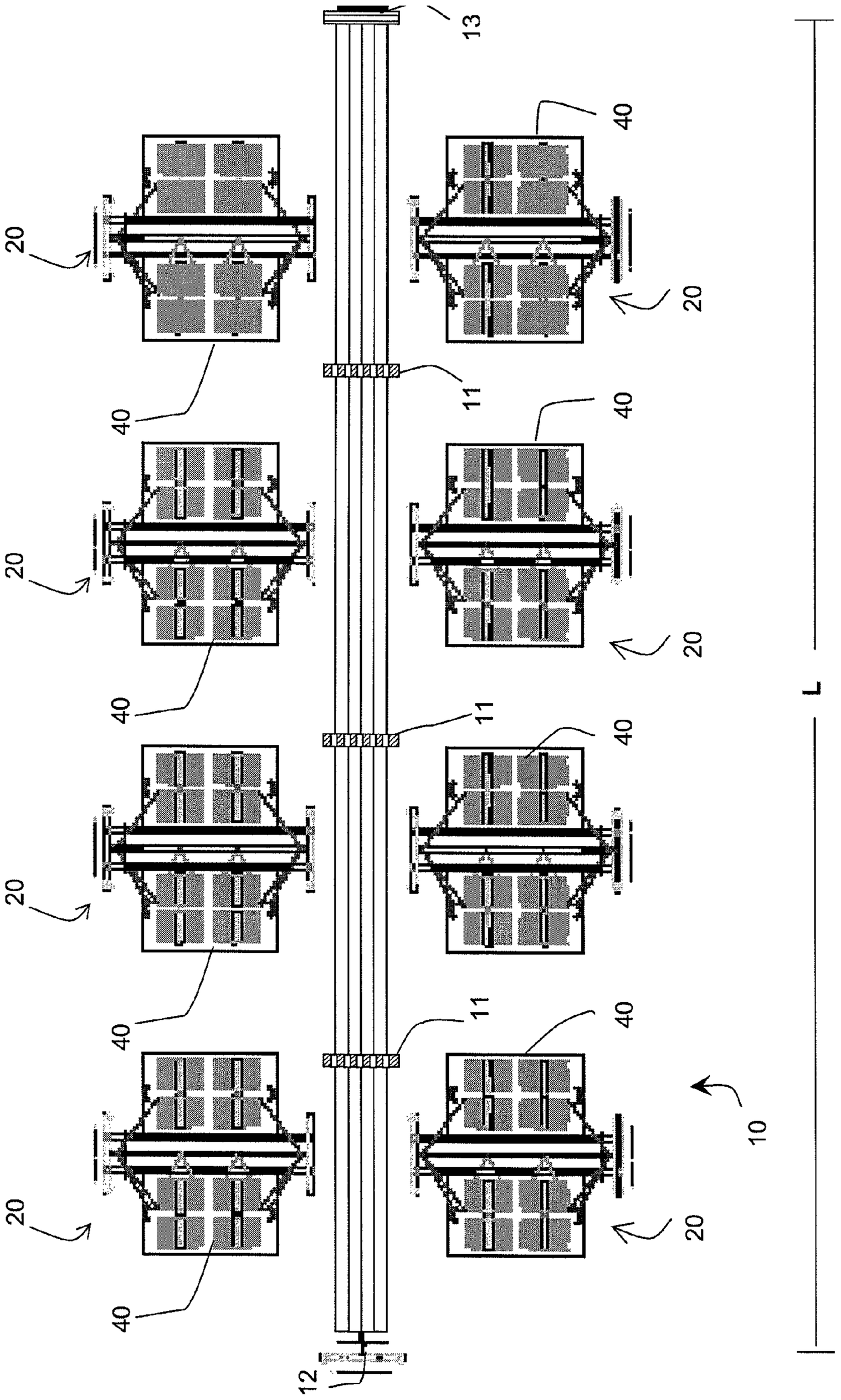


FIG. 3

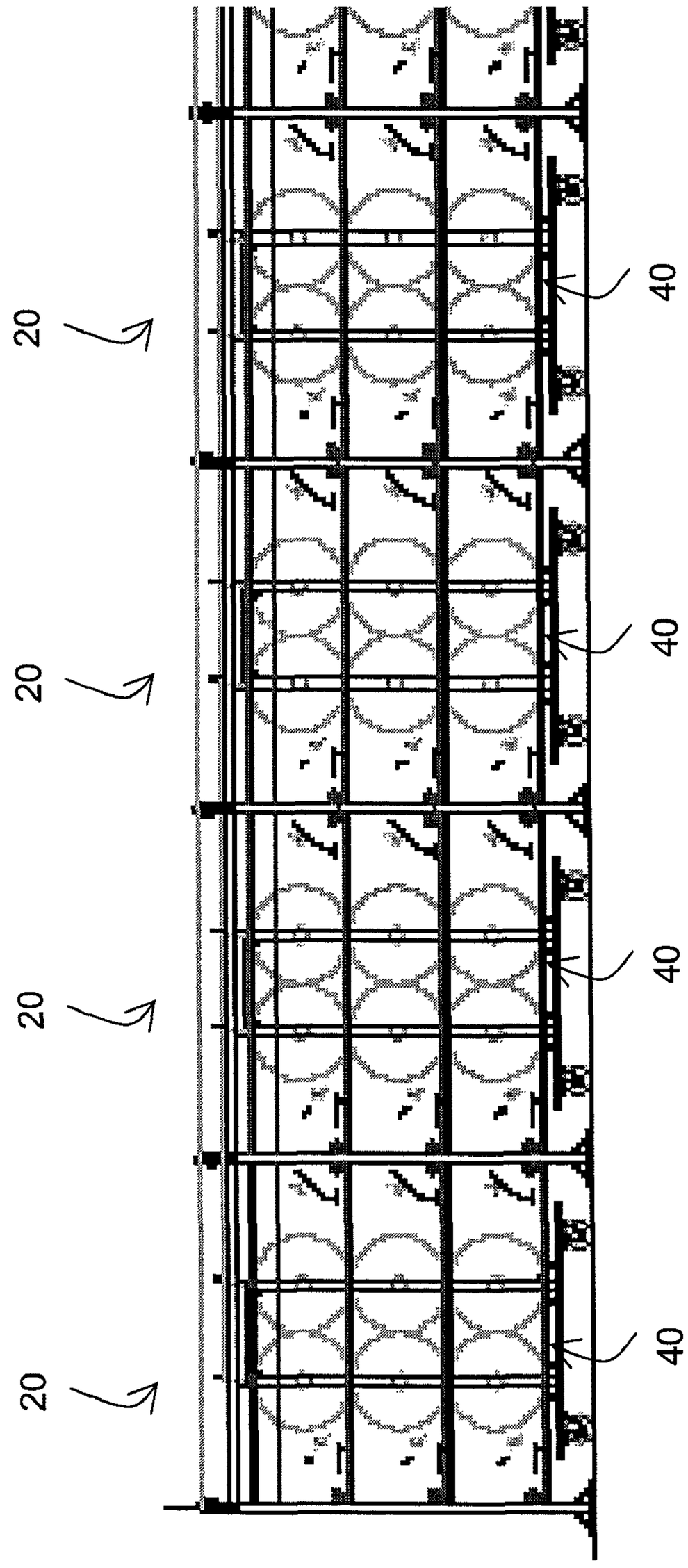


FIG. 4A

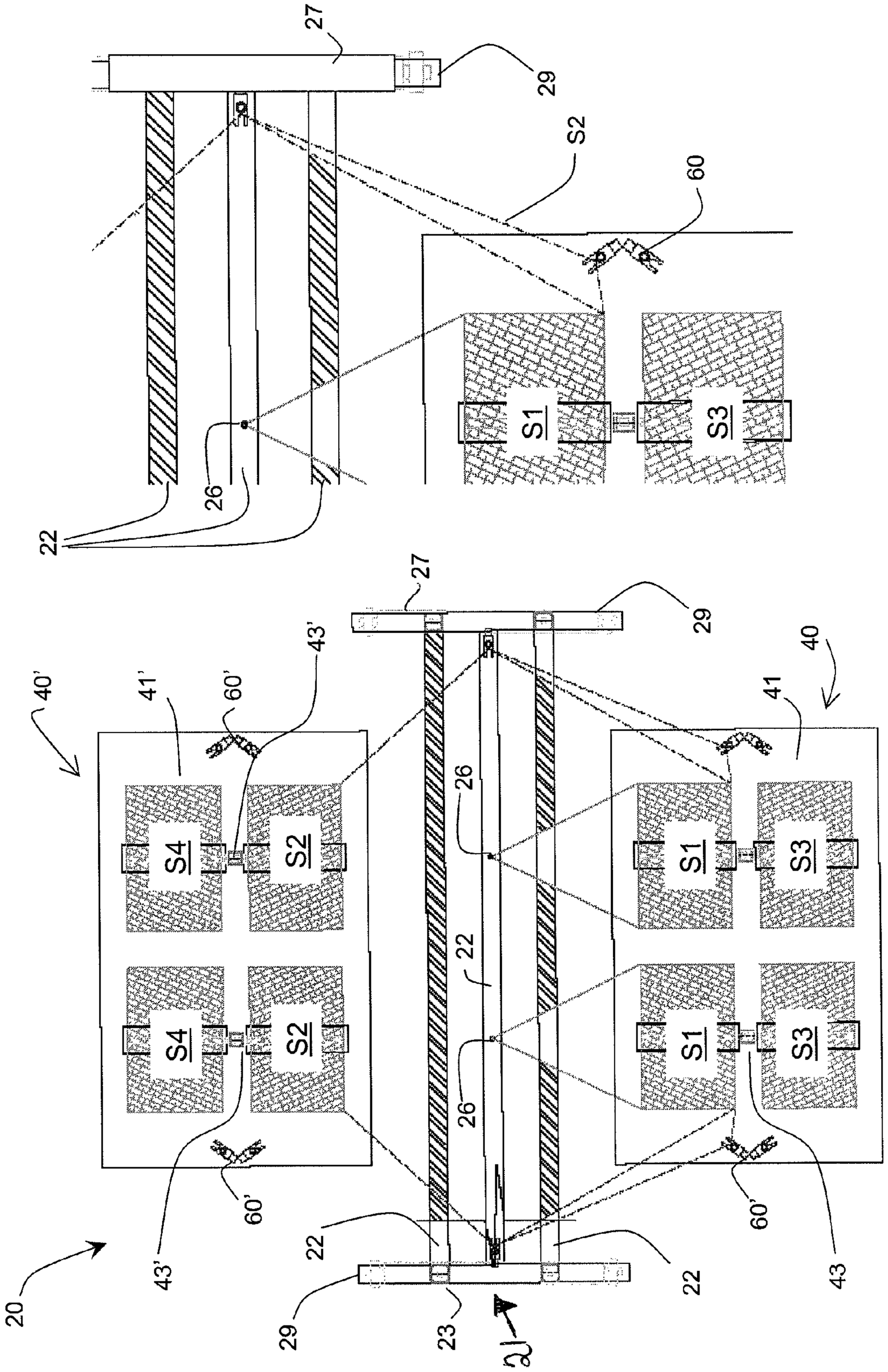
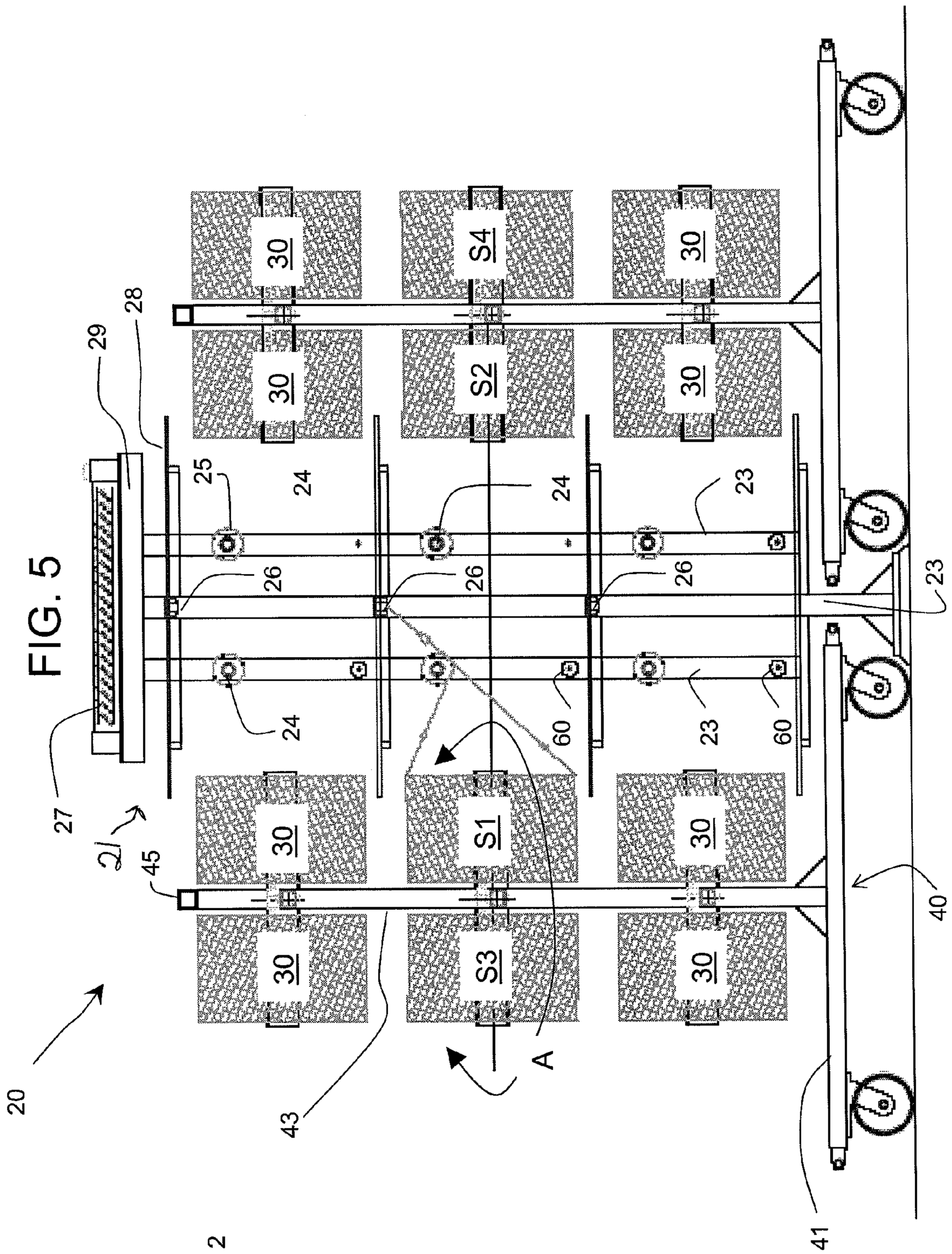

27
29
S2
60
S1
S3
22
26
27
29
43'
40'
41'
60'
40
41
S4
S2
S1
S3
26
22
22
60'
43
22
29
23
20
43'

FIG. 5


30
S4
30
28
29
30
S2
30
25
24
24
23
26
26
26
23
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60
27
21
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S1
30
45
40
30
S3
30
A
20
43
41
2

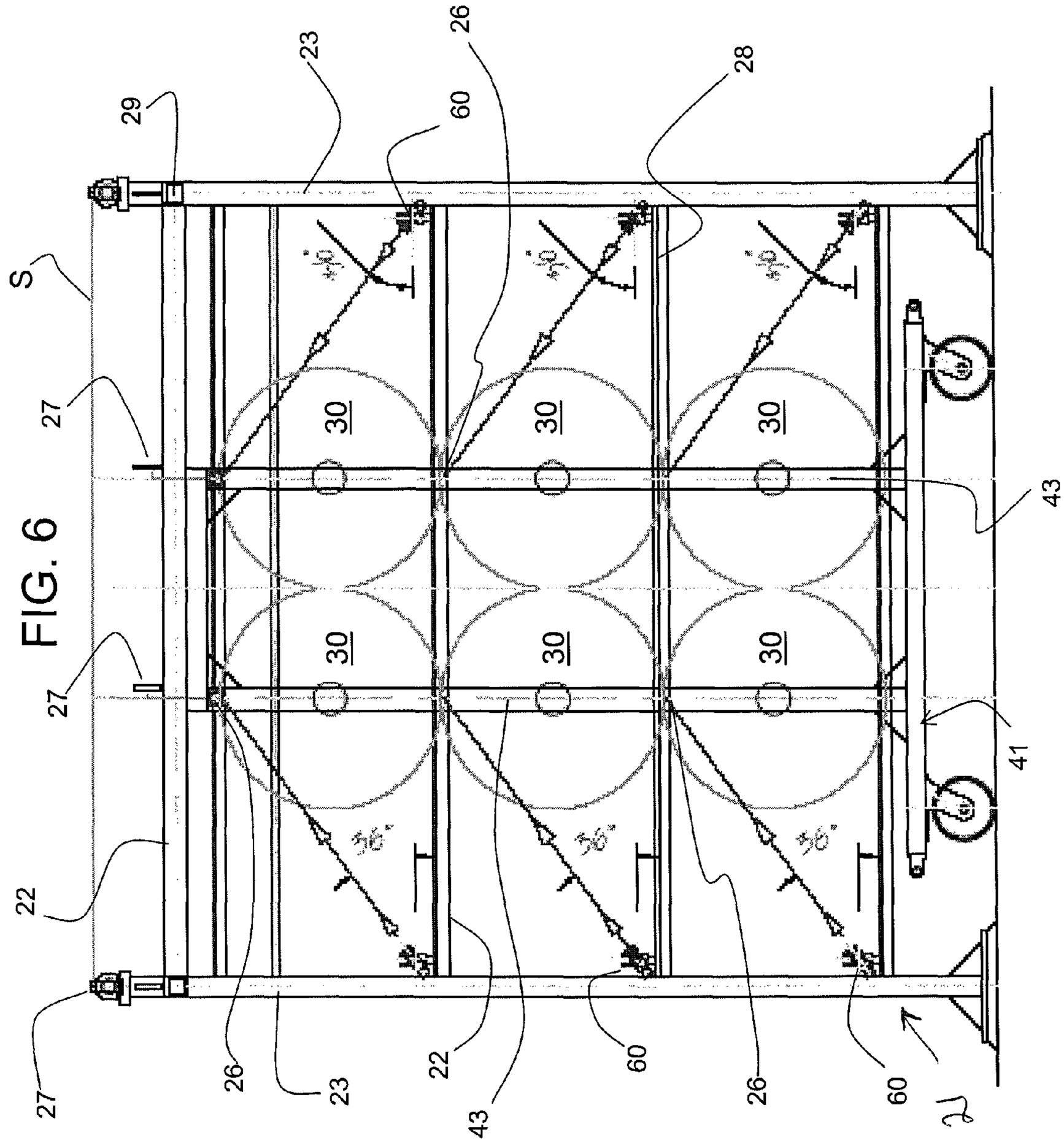


FIG. 6

FIG. 8

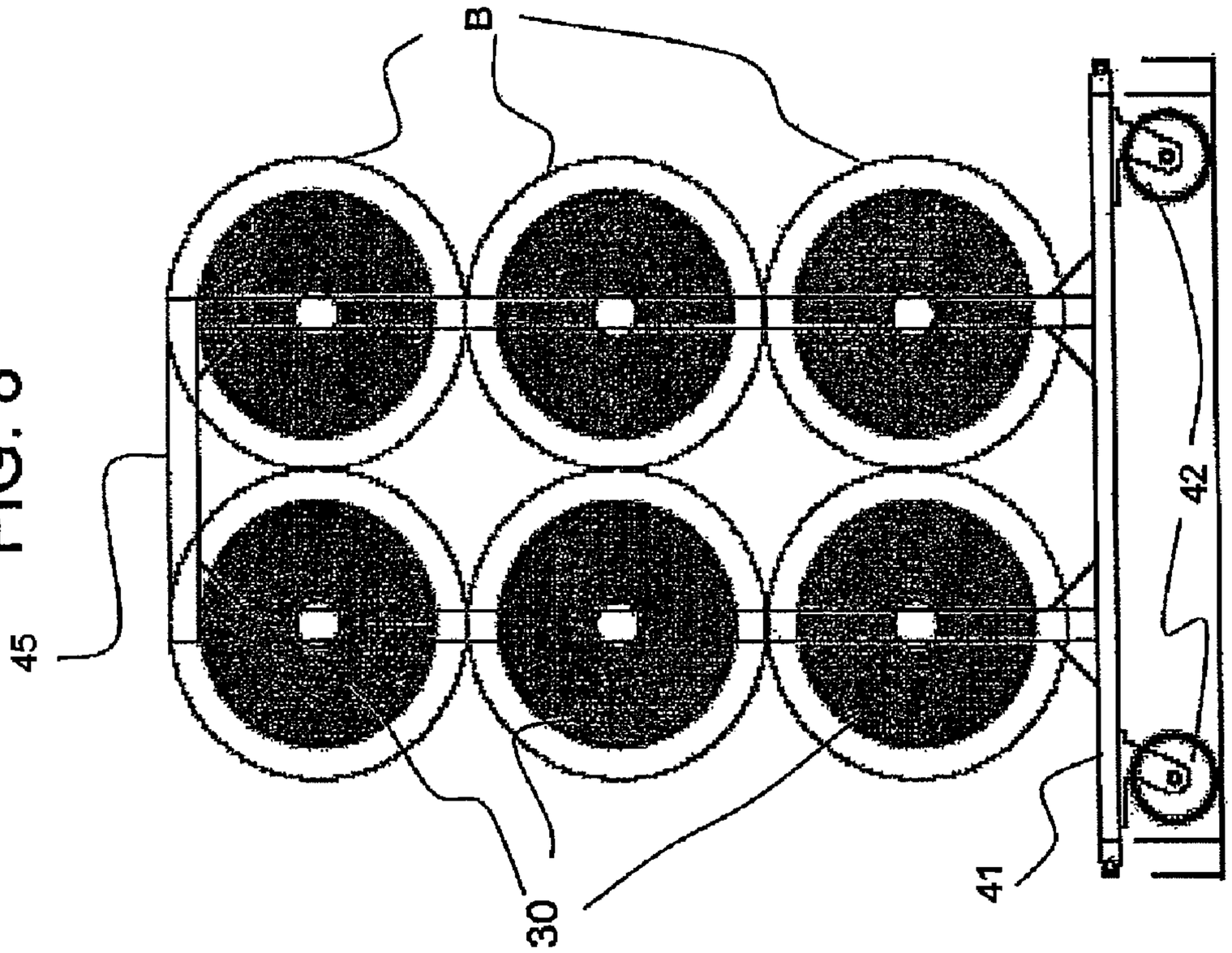


FIG. 7

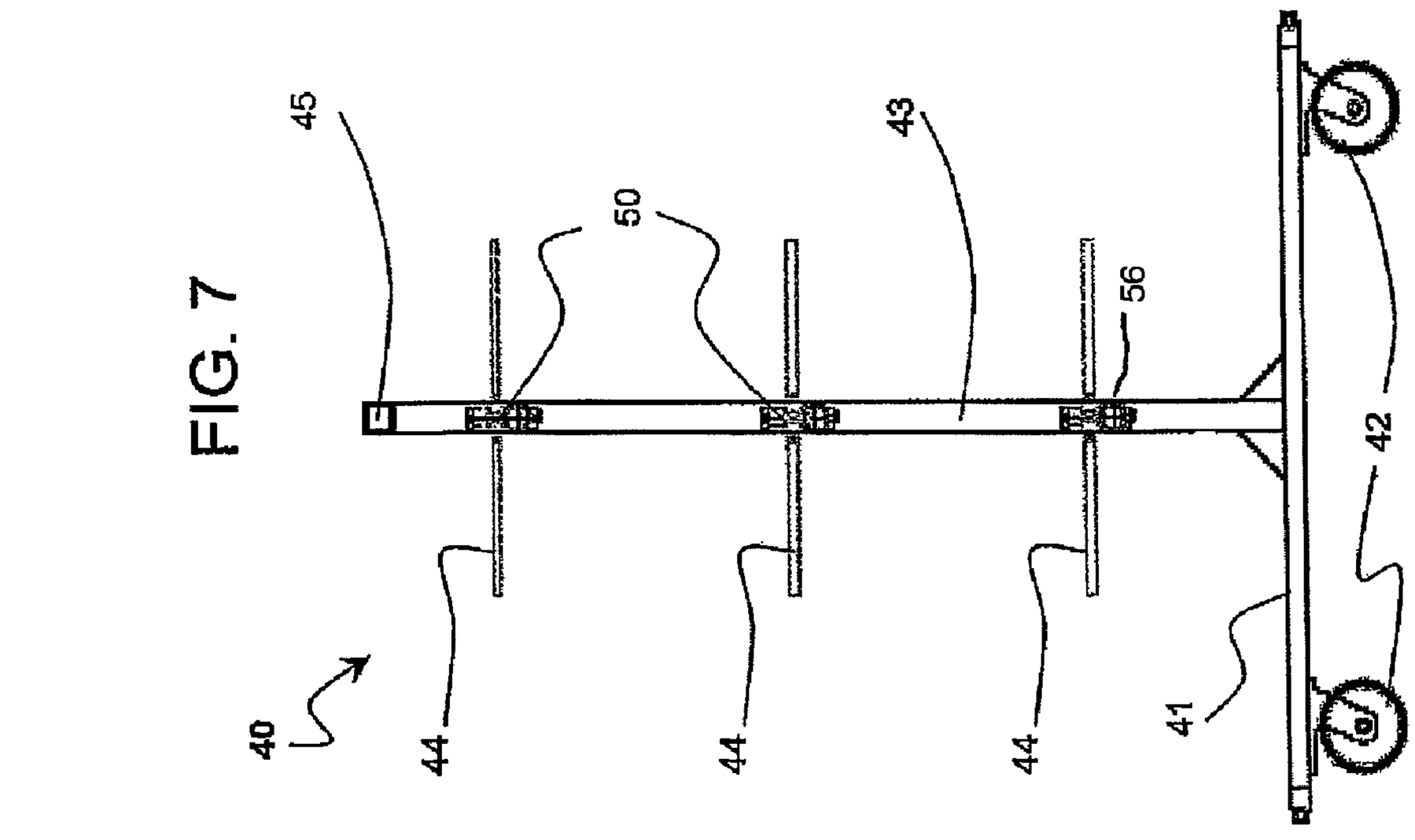


FIG. 9

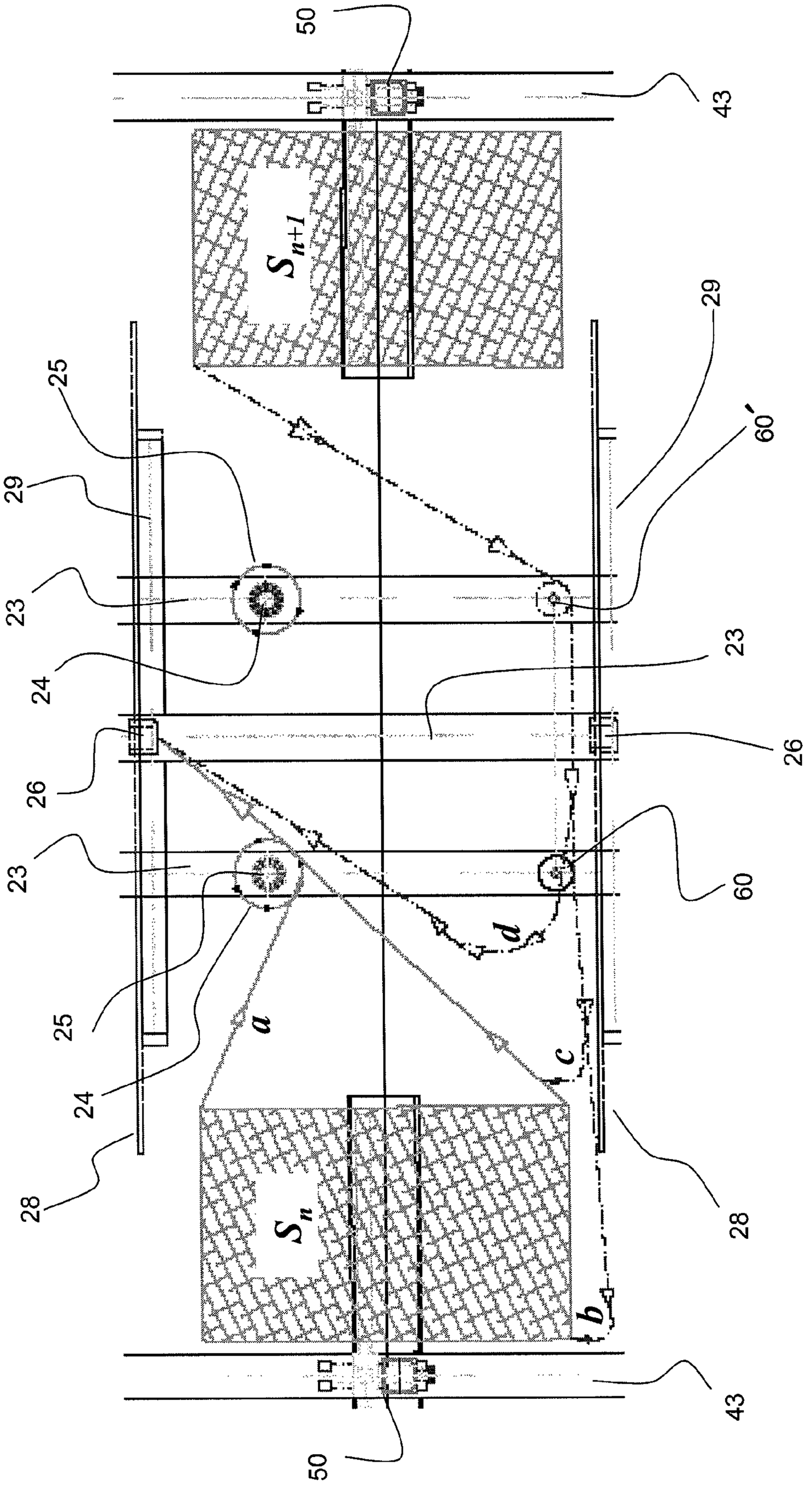


FIG. 10A

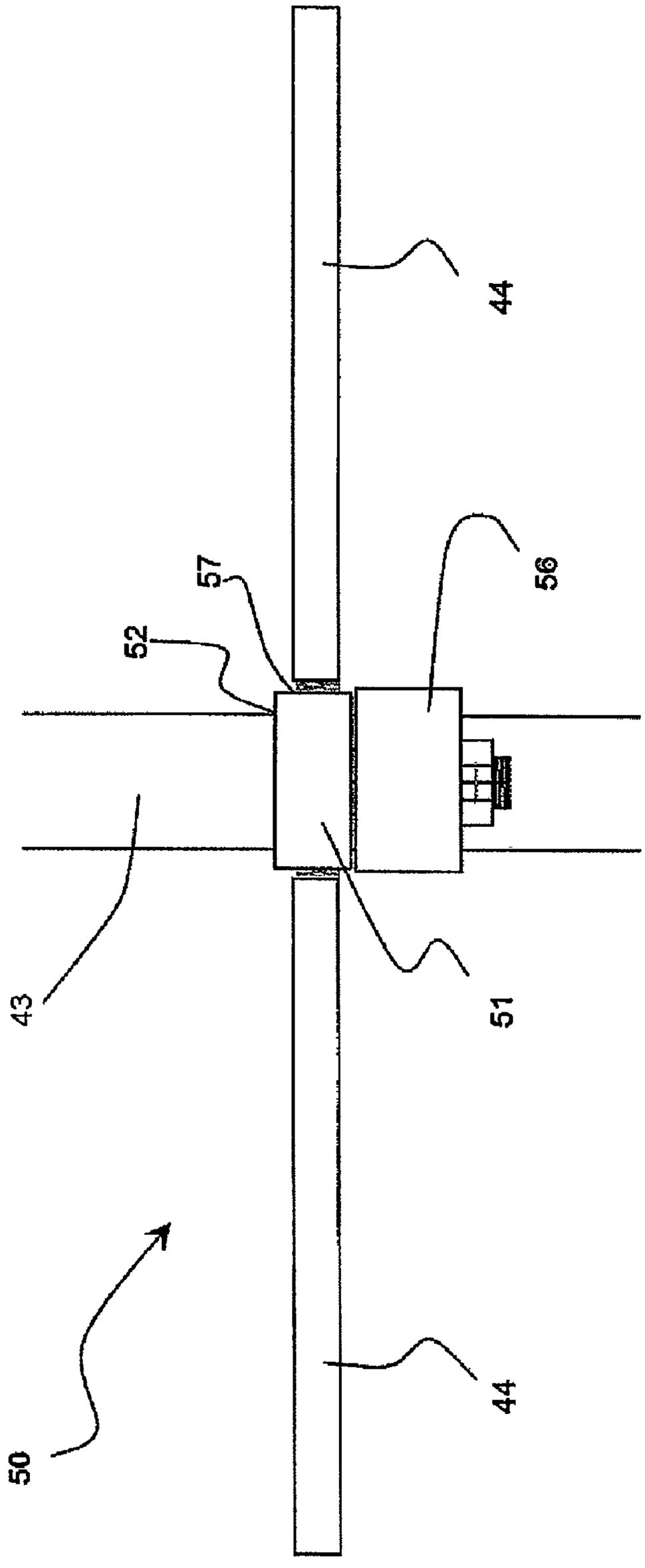


FIG. 10B

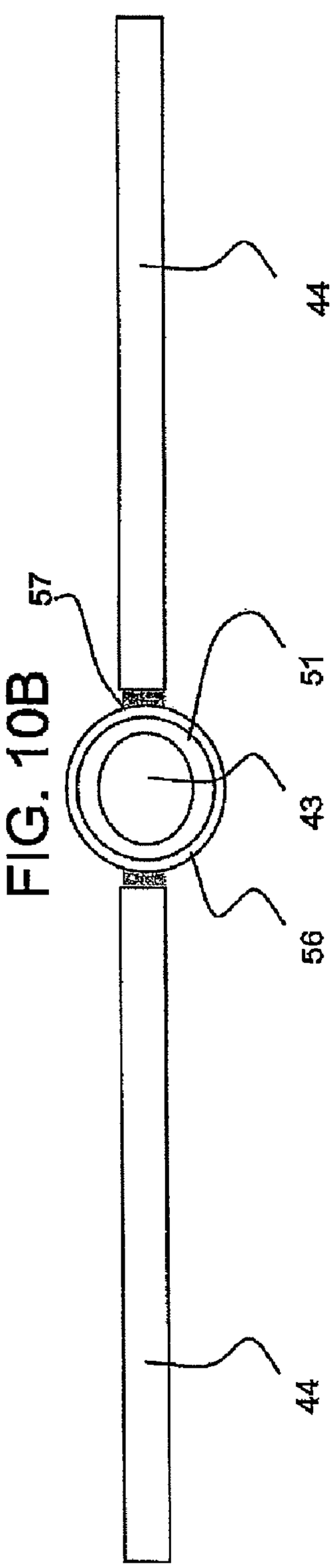


FIG. 11

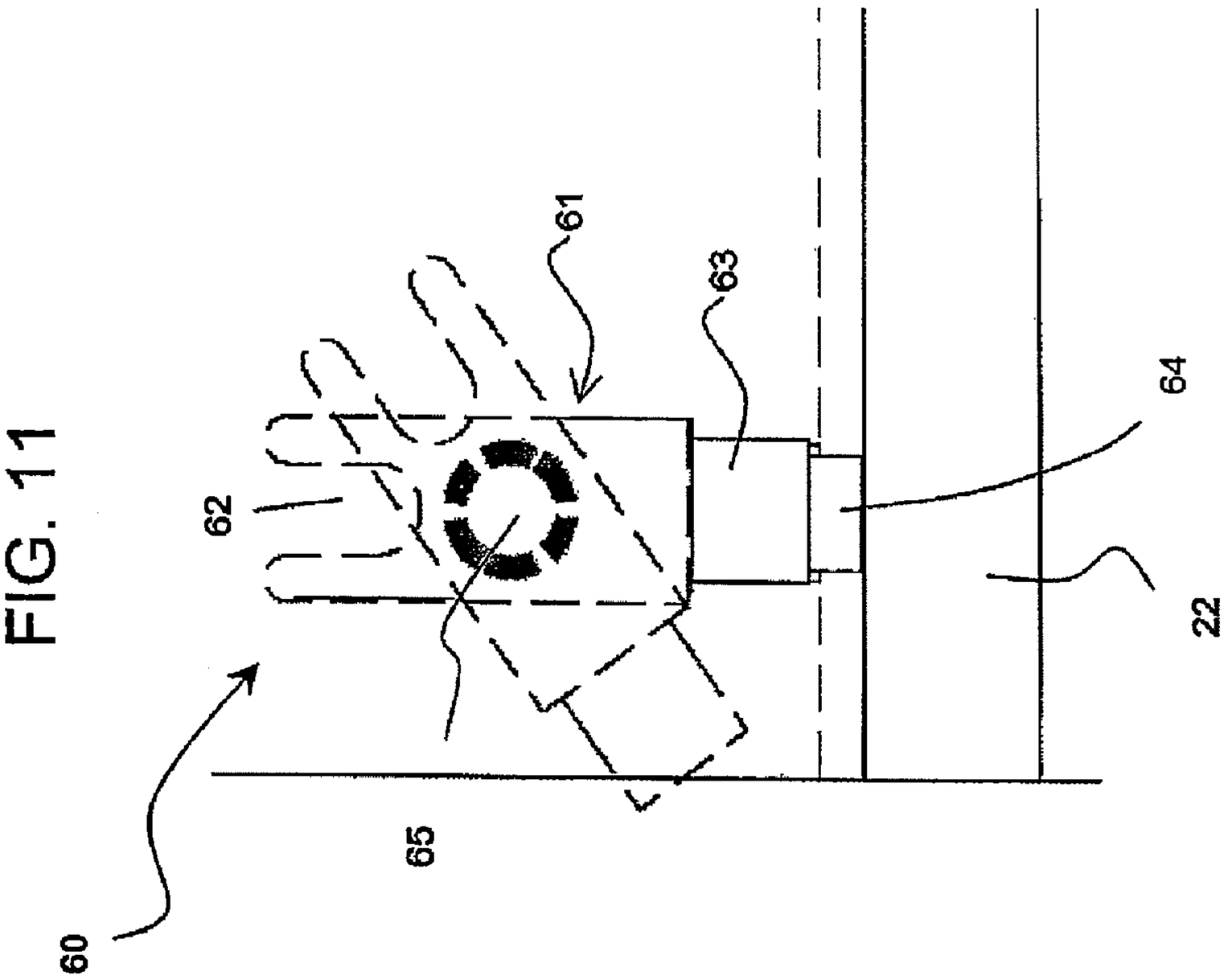
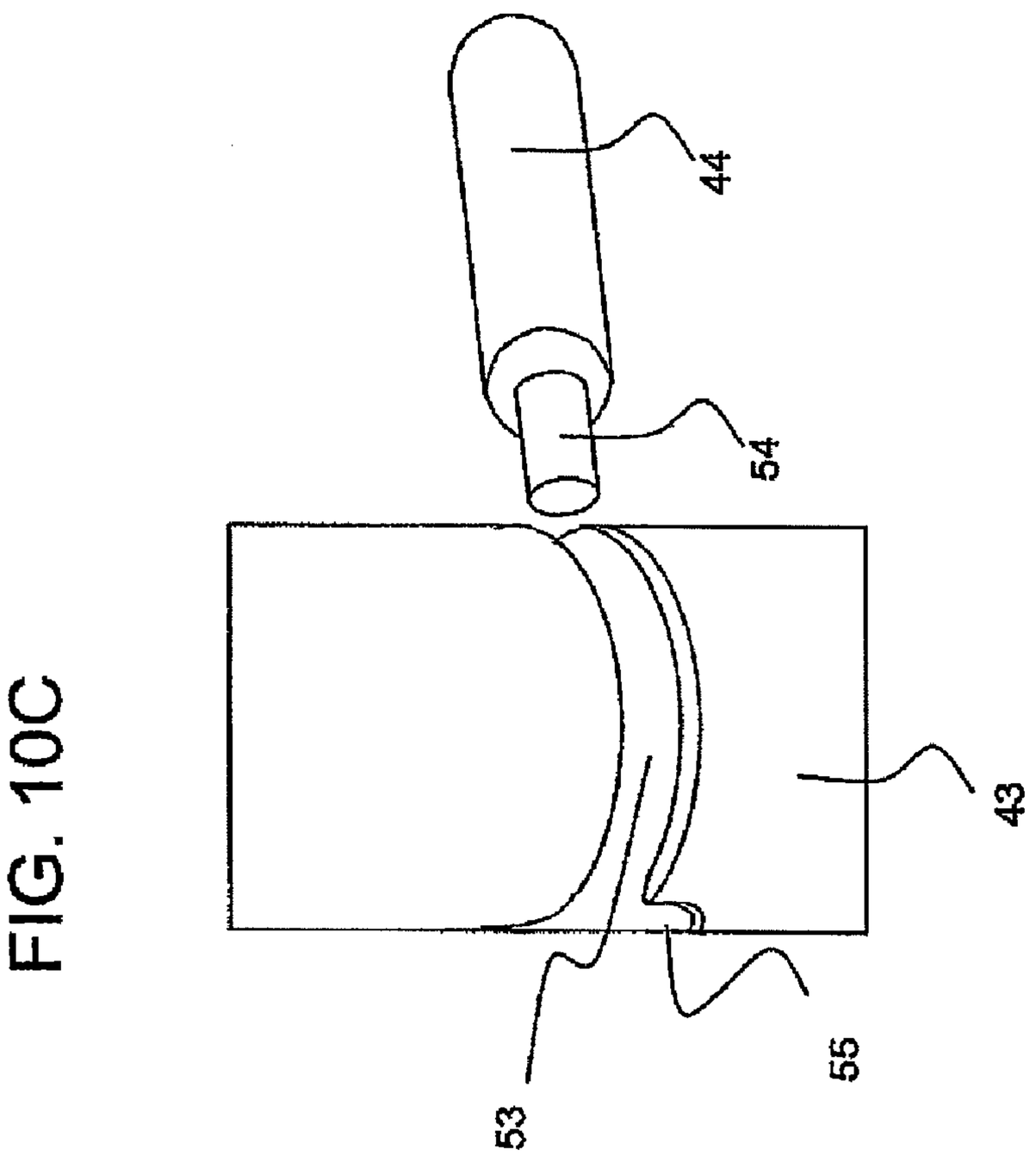


FIG. 10C



CREEL MAGAZINE SUPPLY SYSTEM AND METHOD

This application claims priority from U.S. Provisional Patent Application No. 60/885,743 filed Jan. 19, 2007 incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Technical Filed

The present invention generally relates to creels used for supplying stranded materials to a machine or process for subsequent treatment of the stranded materials or for the fabrication of articles out of the stranded materials. More particularly, the present invention relates to an apparatus and method for supporting a plurality of spools of stranded material, or packages, such that the stranded material carried by the packages may be sequentially supplied to a machine or industrial process. With even greater particularity, the invention relates to a creel magazine capable of receiving and guiding a predetermined number of strands of material to a machine or industrial process, wherein a creel cartridge carries a plurality of material packages sequentially connected for each of the predetermined strands.

2. Related Art

The use of creels for supporting stranded material packages is well known in the textile industry and finds application in other industries utilizing stranded materials as well. Modern high-speed processing systems require a continuous, uninterrupted supply of yarns, fed from a plurality of yarn packages supported throughout the creel. However, despite their widespread use, the task of loading and maintaining the supply of stranded materials in the creel remains an extremely labor intensive operation, involving both gross and fine motor skills. Moreover, the efficiency of these systems is dependent upon the ability to provide a continuous stream of material to the process. Interruptions of the process are usually caused by a breakage of the stranded material which occur most frequently where successive material packages are joined, such as by a knot or other methods well known in the art.

Depending on the location of the breakage, process down time can be a matter of minutes, reflecting system shutdown, fault diagnosis, rejoining the broken strands, and system restart procedures. Moreover, modern high speed processing systems are usually designed with fault detection measures that are intended to prevent broken strands from entering the processing machinery. However, should these systems fail and a strand breakage enters the system, or where a strand breaks internally of the system, delays on the order of hours may be experienced as the entire machine will need to be reset.

Conventional creel systems utilize yarn package supports which are arrayed on a plurality of support posts extending from a free standing frame of the creel and positioned so as to feed the manufacturing process. Eyelets or other guide means are provided vertically and laterally throughout the creel through which each of a plurality of yarn strands are fed to the processing system. Accordingly, monitoring, loading and maintenance of the creel is performed from a front side of the creel so that the operators will not be exposed to hazards presented by running lengths of stranded materials extending from the back side of the creel. In the typical process, a pair of package supports are configured in alignment with each eyelet and the respective yarn strands from the paired packages are tied or otherwise attached in series to alternately feed the process.

Replacement of a yarn package in a creel typically requires a worker to remove a rotate a depleted package cone out of the creel from its working position to a loading position; remove and dispose of a spent cone from the package holder; lift the replacement yarn package from a delivery platform, such as a pallet or bulk container cart; transport the package to the indicated package support; manipulate the package to mount it on the package support; rotate the replenished package support into the creel; and tie or otherwise secure the lead end of the replenished yarn package to the tail end of the paired feeding yarn package. As can be readily seen, the operation and maintenance of a typical creel is and remains a labor intensive task

In systems utilizing manual loading methods, a typical package will be limited to having a weight on the order of 8 to 14 pounds. In a given shift, a textile worker tasked with loading and maintaining the creel in a conventional process will lift, transport, and manipulate as much as six thousand pounds of packaged materials. Because the package supports are arrayed at varying heights and distances from the delivery platform, the typical laborer is subjected to significant risk of musculo-skeletal injuries presented at each step of the yarn package replacement process. Moreover, because the loading and replenishment of individual packages occurs at the creel, the activity remains a complex labor intensive one when combined with the related tasks of monitoring the condition, maintenance and performance of the system. Accordingly, there remains a need for improving the efficiency and reducing the complexity of creel operations.

BRIEF SUMMARY OF THE INVENTION

Objects of the present invention are to improve the efficiency of creel systems utilized in manufacturing processes utilizing packages of stranded materials. This object is realized by providing the process with a pre configured supply of materials ready for direct loading into the creel. The preconfigured supply of materials, carried on movable carts, or cartridges, are preferably loaded by automated means at a separate work station. More preferably, the packages are loaded directly onto the cartridge following completion of a preceding process. Other aspects of the invention provide means for reducing the complexity of operator tasks performed at the creel, thereby relieving the risk of musculo-skeletal stresses on the laborers tasked to operate a creel and improving efficiency and performance of the operator manning that station.

The invention also alleviates risks to operators associated with high speed running strands of material as they are supplied to the process, such as the risk of severing appendages. This hazard is reduced significantly by elevating the running strands overhead of the operator's work station.

BRIEF DESCRIPTION OF THE SEVERAL DRAWINGS

FIG. **1** depicts an overhead plan view of a stranded material magazine supply system for a manufacturing process.

FIG. **2** depicts an alternative overhead plan view of a stranded material magazine supply system for a manufacturing process.

FIG. **3** depicts a side elevational view of a stranded material magazine supply system for a manufacturing process.

FIG. **4**A depicts an overhead plan view of a magazine.

FIG. **4**B depicts a detailed view of material routing in the magazine shown in **4**A.

FIG. **5** depicts an end elevational view of a magazine.

FIG. **6** depicts a side elevational view of a magazine.

FIG. **7** depicts an end view of a cartridge.

FIG. **8** depicts a side elevational view of a cartridge.

FIG. **9** depicts a detailed end elevational view of the threading of successive packages.

FIG. **10**A depicts a side elevational view of a cartridge post and package rotator.

FIG. **10**B depicts an overhead plan view of a cartridge post and package rotator.

FIG. **10**C depicts a perspective view of a guide channel, defined in a cartridge post.

FIG. **11** depicts a side elevational view of a transfer device.

DETAILED DESCRIPTION OF THE INVENTION

The creel magazine supply system and method of the present invention may be constructed as a complete system or is adaptable to an existing manufacturing facility working stranded materials. In reference to FIGS. **1-4**, the system comprises a creel **10**, a plurality of creel magazines **20** each containing a plurality of spools of stranded material, or packages **30**. After leaving the creel magazines **20**, the running ends of the stranded material S are routed to the manufacturing process via creel **10** comprising a plurality of guides **11**, guide boards **12**, or return rollers **13**, supported in the facility according to conventional methods. As will be appreciated by those of skill in the art the length of the creel run L, is generally determined by the machine or process treating the stranded material, particularly with respect to parameters for detecting and preventing material breaks from entering the machine proper, such as the machine operating speed, break detection time, and machine interrupt or shut down times.

The creel magazine supply system and method is designed around magazine **20** comprising a pair of movable replenishable carts, or cartridges **40** and a stationary magazine frame **21**. Each cartridge **40** is configured to carry a plurality of packages **30**. In the embodiment described, cartridge **40** allows for six running ends of material S to be fed to creel **10** at a time. As may be seen in reference to FIGS. **5** and **6**, each cartridge **40** is configured to carry packages **30** in an array of two vertical columns and three rows at a depth of two packages **30** each, for a total of twelve packages **30** per cartridge **40**, and total of twenty four packages **30** in a magazine **20** utilizing two cartridges **40**.

As may be appreciated, magazines **20** can be arranged to supply creel **10** with any number of running ends of material S. Utilizing the maximum capacity of each magazine **20** configured as described above, incremental strand counts of 48, 42, 36, 30, 24 may be readily achieved according to the needs of the manufacturing process by the addition or subtraction of magazines **30** to the site layout. Magazines **20** may be arranged any number of ways determined by the physical dimensions and process requirements of the manufacturing facility. In a preferred configuration, such as that depicted in FIG. **1**, magazines **20** will be angled with respect to the creel run L towards return roller **13** to help reduce friction on the material S and drag on the machine as it pulls the material into the process. An angled design also allows for better access to the magazine **20** and cartridges **40** or carts for tying and routing strands and other maintenance tasks. Maintenance in this area is typically referred to as a "break out" and must be attended to by the machine operator.

In reference to FIGS. **7-8**, replaceable cartridge, or cart **40**, is comprised of a platform **41** supported by ground wheels **42** and a post, or vertical frame **43** mounted to and extending from platform **41**. In the embodiment depicted, support arms **44** are provided in opposed pairs, pivotally mounted to vertical frame **43** via a package rotator **50**. As may be seen, package rotators **50** are attached to vertical frame **43** arranged in a creel like fashion having a predetermined number of columns, rows and banks defining a array which are selected based upon facility requirements or other operational considerations. In this embodiment support arms **44** are arranged in a 2×3×2 array, that is two columns, three rows, and two banks, about vertical frame **43** for a total of twelve packages **30** per cartridge **40**. A horizontal frame member **45** may be provided between adjacent vertical frame members **43** for added support.

In the configuration depicted, package rotator **50** permits rotation of support arms **44** through an arc of 180 degrees about a vertical axis corresponding to its respective vertical frame member **43**. Package rotator **50** is comprised of support arms **44** attached to and extending laterally outwardly from a collar **51**. Collar **51** rotates about a rotator bearing surface **52**, which is provided with a guide channel **53**. Guide channel **53** receives a guide pin **54** extending from an inner surface of collar **51**, to guide and constrain the extent of rotation of support arms **44**. Guide channel **53** should also have a detent **55** to ensure positive alignment of support arm **44** and to alert the operator when support aim **44** is rotated to the correct position.

Package rotator **50** may be configured according to the arrangement described in U.S. Provisional Patent Application No. 60/885,743, incorporated herein by reference, with guide channel **53** defined in a substantially horizontal plane. Alternatively, instead of providing a discrete rotator bearing, rotator bearing surface **52** may be provided by an outer surface of the vertical frame members **43**, and guide channel **53**, may be cut in the vertical frame members **43**. Package rotators **50** are positioned at an appropriate elevation on vertical frame **43** based on the diameter of the package **30** and material being utilized in the manufacturing process. A modified set collar **56** may be mounted below each rotator bearing surface **52** to support collar **51** at the bearing surface **52**. Collar **51** may then be slid down vertical frame **42** during assembly. In the embodiment depicted, collar **51** has threaded apertures **57** spaced 180 degrees apart. The support arms **44** may then be inserted into the threaded apertures **57** to protrude into the guide channel **53**, thus allowing 180 degree movement around the upright **23** and supporting the weight of the package **30**. As best seen in reference to FIGS. **4**A and **4**B, cartridge **40** further comprises a guide system for routing stranded material S to magazine **20** when cartridge **40** has been inserted into magazine **20**.

Referring to FIGS. **4**, **5** and **6**, stationary magazine frame **21** is secured to the floor of the manufacturing facility and is fed material supplied from either side of magazine frame **21** by packages **30** carried by cartridge **40**. Stationary magazine frame **21** comprises a plurality of longitudinal members **22** interconnecting upright members **23**. Upright members **23** are spaced apart by a distance corresponding to the width of cartridge **30**. Horizontal members **22** are positioned between upright members **23** at a position slightly above its associated package **30** carried by cartridge **40** and below a subsequent package **30** positioned above the associated package **30**. Magazine frame **21** and cartridges **40** should be configured such that cartridges **40** are received within in the frame **21** in proper alignment and are properly secured to prevent unwanted movement during use. Any suitable means are acceptable, for example, carts **40** may be indexed with respect to magazine frame **21**, a floor tracks or even cartridge guides, whether incorporated with frame **21** or ancillary to them may also be suitable.

Magazine frame **21**, includes a magazine guide system that will accommodate each running end of material S supplied by

cartridge **30** and route it to the creel **10**. As best seen in reference to FIG. **5**, the guide system includes guide rods **24** extending laterally and inwardly from upright members **23** towards the interior of magazine **20**. Guide rods **24** are positioned slightly above a longitudinal axis of its associated package **30**, and laterally outwardly from a longitudinal centerline of magazine frame **21**. As will be recognized by those skilled in the art, particularly with respect to stranded materials such as yarns utilized in textiles, as the yarn is pulled from the package **30**, it will unwind from package **30** and form a balloon around and at the end of the package **30**. Guide rod **24** is positioned to reduce the diameter of the balloon coming off the package. Preferably, guide rod **24** will be vertically adjustable to maintain a limiting effect on balloon formation as package **30** is depleted. Guide rods **24** may include a roller sleeve **25** to reduce friction between the rod **24** and material S. Primary guides **26** are provided in horizontal members **22** in spaced relation to each other to direct each strand of material from guide rod **24** and route it vertically to the top of magazine **20**. Primary guides **26** are preferably ceramic, but may be made of any suitable material. Secondary guides **27**, which may include a guide board or roller, are mounted on an upright member **23** proximal to creel **10**, and receive material directed laterally from an uppermost set of primary guides **26**. Material leaving secondary guides **27** is then directed towards and carried by guides **11**, guide boards **12**, and/or return roller **13** of creel **10**, depending upon the magazine's placement in relation to creel **10**.

To reduce the potential for the balloons of adjacent packages becoming entangled, magazine frame **21** may also be provided with a shield **28** mounted to transverse members **29** attached to and extending perpendicular to upright members **23**. More preferably, shield **28** is comprised of a transparent material, such as glass or plexiglass, so that the operator may visually inspect the condition of the yarn feeds within magazine **20** and that of the supplying packages **30** and cartridges **40**. A transparent shield **28** will also facilitate the operator's ability to join and route successive running ends.

The configuration of the creel magazine supply system thus described permits improved efficiency in the delivery of stranded material to a manufacturing process. First, the transportability of cartridges **40** permits loading of packages **30** by automated methods such as that disclosed in U.S. Provisional Patent Application No. 60/885,743, so that loading of packages **30** onto support arms **44** is performed remotely from the magazine **20**, thereby reducing the complexity of tasks performed at the magazines **20**. Similarly, because cartridge **40** may be loaded via automated means, the size, and thereby the length of stranded material carried by a package **30** may be dramatically increased, from the 8-14 pounds in conventional manual systems, to at least forty pounds permitted by automated loading systems. Because the strand length is increased, a significant source of breakages, i.e. knots or joints, are substantially reduced, thereby contributing to the efficiency and reliability of the process.

Next, the magazine configured creel eliminates a primary and substantial source of musculo-skeletal injury exposure presented by loading packages **30** at the creel. By providing a mobile, fully loaded cartridge **40**, the magazine **20** can be replenished without lifting necessary in conventional methods. As will be more fully described below, the creel magazine **20** of the present invention permits the system to be pre-loaded with at least four packages **30** of material prior to initiating a run. The unique configuration of the magazine **20** and its associated cartridges **40** permits each of four packages **30** to be fed in sequence to the manufacturing process, alternating between packages **30** carried on a first cartridge **40** and second cartridge **40'**. As annotated in FIG. **5**, packages S**1**-S**4**, are fed sequentially to magazine **20**, in a modified tip to tail, back and forth fashion, whereas current systems feed tip to tail in a side by side configuration. This magazine configuration and method effectively doubles the initial package **30** capacity of the creel **10** from two packages **30** to four.

To run packages **30** in the modified tip to tail fashion, the leading end of material from package S**1** is routed under guide rod **24** and then upwardly through primary guides **26** to the top of magazine **20**. From there, the leading end is carried horizontally to secondary guide, or guide board **27** and then integrated with the guides **11**, guide boards **12**, or return roller **13** of the creel **10** depending upon a magazine's **20** placement in the process configuration. Each of the six corresponding S**1** packages are routed in similar manner. By guiding the materials to the top of the magazine frame **21**, the operators may have ready access to the magazine **20** and its associated cartridges **40**.

As may be seen in reference to FIG. **9**, the trailing end of package S_n is tied or joined with the leading end of package S_{n+1}, which is mounted on cartridge **40'** positioned transversely across magazine **20** from cartridge **40**. As previously described, as the yarn spools off its package **30** it creates a balloon around the package **30**. Therefore, when joining the tip of a subsequent package S_{n+1} to the tail of its preceding package S_n, the joined material, primarily the leading end of S_{n+1}, must be retained out of the way to prevent the "balloon" on the running package S_n from tangling. In like manner, the running of material from the subsequent package must be allowed pull thru and out of the retaining apparatus once transfer to the subsequent package commences.

To achieve this, a transfer device **60**, such as that depicted in FIG. **11** is provided mounted near the center line of the magazine frame **21** to the outside of each package **30** running position, as may be seen in reference to FIGS. **6** and **9**. Transfer device **60** comprises an elongate member, or bar **61**, having a U-shaped notch **62** formed at a first end of bar **61** and a counterweight **63** formed at a second end of bar **61**. Bar **61** is pivotally mounted to a post **64** via a pivot **65**. Counterweight **63** is selected such that notch **62** is oriented vertically in a retaining position and that slight lateral forces will permit bar **61** to pivot and orient notch **62** to a release position.

In reference to FIG. **9**, the routing of the running ends is depicted in detail illustrating the initial routing of package S_n, the modified tip to tail side by side interconnection of packages S_n and S_{n+1}, and the transfer of material supply between S_n and S_{n+1}. The initial routing of the running end of package S_n is shown by the arrowed line a, at the top of the left hand package S_n. The running end is routed under guide rod **24** and upwardly to primary guide **26**. At the lower left hand side, the leading end of yarn S_{n+1} is depicted by dashed arrowed line b, and is shown tied to the tail end of package S_n and is routed through transfer device **60**. As the material from package S_n is depleted, the joined ends of material S_n and S_{n+1}, are drawn towards guide rod **24** and primary guide **26** as depicted by the joined lines at c, at the lower end and slightly to the right of package S_n. As the joined ends are drawn upwardly towards primary guide **26**, running end S_{n+1} begins to exert pressure on the side of notch **62** so that transfer device **60** tips laterally to release running end S_{n+1}, from notch **62**, shown by dashed line d, effectuating transfer of supply from package S_n to package S_{n+1}, which will be complete once the running end of S_{n+1} is released from transfer device **60'**. Depending upon the diameter of packages **30**, an additional transfer device **60** may be required to be positioned on each cart and at the outer ends thereof, so that effective retention and transfer may be effectuated. Upon complete transfer, running end S_{n+1} will be

pulled upwardly until engaging guide rod **24'** and routing will proceed according to the initial condition for package S_{n+1}. After transfer to package S_{n+1} is complete the depleted package S_n is rotated about axis A as depicted in FIG. **5** and fresh package **30** is positioned within magazine frame **21**. In repeating the sequence, the previously defined package S_{+1} becomes S_n and the rotated replenished package **30** becomes the next S_{n+1}. According to this method, a fully loaded creel magazine **20** can provide an initial run twice that of conventional creels before the magazine **20** will require replenishment, thereby leading to greater efficiency in the process. As will be readily appreciated, once a cartridge **40** is depleted, it may be removed from the magazine **20** and replaced with a replenished cartridge **40**, and the process continued.

Thus, one of the may objectives of the present invention is to allow the cartridges **40** to be loaded at a remote location so as to eliminate loading tasks at the magazine **20**. Additional efficiency may be realized where a material undergoes a prior process to be produced as a package **30** at the conclusion of that process. Customarily, packages **30** produced in a previous process are simply loaded and stacked in a bulk carrying cart and then wheeled to the next process station at which the packages **30** are then manually removed from the bulk carrying cart and loaded into the next process. By the method contemplated by the present invention, the packages **30** may be directly loaded onto a cartridge **40** upon completion of the previous process, thereby saving labor costs and increasing efficiency by eliminating double handling the packages **30**.

While this invention has been described with reference to preferred embodiments thereof, it is to be understood that variations and modifications can be affected within the spirit and scope of the invention as described herein and as described in the appended claims.

I claim:

1. A creel magazine for supplying stranded materials to a manufacturing process comprising: a stationary magazine frame and a pair of replaceable cartridges positioned on opposite sides of said magazine frame, each replaceable cartridge comprising a plurality of ground wheels, a generally horizontal platform, a vertical frame, and a plurality of package holders, said plurality of ground wheels supporting said generally horizontal platform, said platform supporting said vertical frame attached to said platform, and said plurality of package rotators pivotally attached to and rotatable about said vertical frame, each said rotator of said plurality of rotators having at least two support arms extending outwardly from said rotator and disposed at a angle relative to one another, said at least two support arms adapted to receive and support a spooled package of stranded material, said package rotators disposed in a predetermined spaced relation relative to said magazine frame; said magazine frame comprising a plurality of upright members, a plurality of horizontal members extending between said upright members at intervals corresponding to the number and size of said packages carried by said cartridge, a plurality of primary guides disposed in spaced relation on said horizontal members, and at least one secondary guide disposed on a lateral end of said magazine frame further including a trailing end of said package on said first side is connected to a leading end of said package on said opposite side, said primary guides and said secondary guides disposed for receiving and carrying a discrete running length of said stranded material fed sequentially from a package carried by a cartridge on a first side of said magazine frame and a corresponding package carried by a cartridge on said opposite side of said magazine frame to said manufacturing process, further comprising a transfer device attached to said magazine frame, said transfer device receiving a length of stranded material between a package carried by a cartridge on a first side of said magazine frame and a corresponding package carried by a cartridge on said opposite side of said magazine frame.

2. The creel magazine of claim **1**, wherein said primary guides are disposed to carry a running length of said stranded material vertically within said magazine creel to a top of said stationary magazine frame.

3. The creel magazine of claim **2**, wherein said secondary guide is disposed to receive said stranded material laterally from said primary guides located at a top of said stationary magazine frame.

4. The creel magazine of claim **1**, wherein said stationary magazine frame further comprises a plurality of guide rods extending generally horizontally and inwardly from said upright members, said plurality of guide rods extending slightly above a longitudinal axis of said package, and interposed between said package and said primary guides.

5. The creel magazine of claim **1**, wherein said at least two support arms extend from opposite sides of said rotator.

6. The creel magazine of claim **1**, wherein said at least two support arms are rotatable about 180 degrees.

7. A creel magazine for supplying stranded materials to a manufacturing process comprising: a stationary magazine frame, a first movable cartridge and a second movable cartridge positioned on opposite sides respectively of said magazine frame, each said movable cartridge comprising a frame and an array of support arms, said frame carrying said array of support arms attached to said frame, wherein each support arm positions a stranded material package mounted on each support arm in a feed position relative said magazine, and a running length of each stranded material is sequentially routed in a plurality of primary guides mounted to said magazine frame wherein a trailing end of stranded material carried by a first package in said first movable cartridge is connected to a leading end of said stranded material carried by a second package in said second movable cartridge, opposite said first package.

8. The creel magazine of claim **7**, further comprising a transfer device attached to said magazine frame, wherein said transfer device releasably receives said connected stranded material.

9. The creel magazine of claim **8** wherein said transfer device releases said connected stranded material as said running length of said stranded material is transferred across said stationary magazine frame.

10. A method of supplying stranded material to a manufacturing process comprising the steps of:

a. providing a plurality of spooled packages holding said stranded material;

b. providing a plurality of movable cartridges for supporting said packages in a predetermined spaced relation on said cartridge;

c. loading said packages on said plurality of movable cartridges in said predetermined spaced relation;

d. positioning a first cartridge of said plurality of movable cartridges at a first side of a magazine frame, wherein said magazine frame is adapted to receive and carry discrete running lengths of said stranded material to said manufacturing process;

e. positioning a second cartridge of said plurality of movable cartridges at a second side of said magazine frame which is opposite said first side relative to said magazine frame;

f. connecting a trailing end of stranded material from a first package at said first side carried by said first cartridge

with a leading end of stranded material from a corresponding second package at said second side carried by said second cartridge;

g. repeating step f for each pair of corresponding first and second packages carried by said first cartridge and said second cartridge;

h. feeding said first packages of stranded material through said magazine frame to said manufacturing process;

i. transferring said feeding to said second package upon depletion of said first package without interrupting said manufacturing process.

11. The method of claim **10** further comprising the steps of rotating a third package carried by said first cartridge to occupy the position of said first package and connecting a trailing end of said second package to a leading end of said third package.

12. The method of claim **11** further comprising the steps of transferring said feeding to said third package upon depletion of said second package without interrupting said manufacturing process.

13. The method of claim **12** further comprising the steps of rotating a fourth package carried by said second cartridge to occupy the position of said second package and connecting a trailing end of said third package to a leading end of said fourth package.

14. The method of claim **13** further comprising the steps of transferring said feeding to said fourth package upon depletion of said third package without interrupting said manufacturing process.

15. The method of claim **14** further comprising the step of replacing said first cartridge with a replenished cartridge.

16. The method of claim **15** further comprising the step of connecting a trailing end of said fourth package with a leading end of a first package carried by said replenished cartridge.

17. A method of supplying stranded material to a manufacturing process comprising the steps of:

a. providing a first movable cartridge carrying a first array of packages holding said stranded material;

b. providing a second movable cartridge carrying a second array of packages holding said stranded material;

c. positioning said first movable cartridge at a first side of a magazine frame which is opposite said first side relative to said magazine frame;

d. positioning said second cartridge at a second side of said magazine frame;

e. delivering said stranded material through said magazine frame to said manufacturing process from a first bank of packages carried in said first array that are adjacent to said magazine frame; and

f. transferring delivery of said stranded material to a first bank of packages carried in said second array at said second side upon depletion of said packages carried in said first bank of said first array.

18. The method of claim **17** further comprising the step of rotating a depleted package in said first bank to position a second bank package adjacent to said magazine frame.

19. A method of supplying stranded material to a manufacturing process comprising the steps of:

a. supplying a running length of said stranded material to said manufacturing process through a guide supported by a stationary magazine frame, said running length initially supplied from a first package of stranded material carried by a first removable cartridge positioned on one side of said stationary magazine frame;

b. connecting a leading end of a second package of stranded material carried by a second movable cartridge positioned on an opposite side relative to said stationary magazine frame with a trailing end of said stranded material carried by said first package; and

c. transferring delivery of said running length of stranded material across said stationary magazine frame to said second package upon depletion of said first package without interrupting supply of said stranded material to said manufacturing process.

20. The method of claim **19** further comprising replacing said depleted first package with a replenished package of stranded material.

21. The method of claim **19** further comprising connecting a leading end of said replenished first package with a trailing end of said second package.

22. The method of claim **21** further comprising transferring delivery of said running length of stranded material across said stationary magazine frame to said replenished first package upon depletion of said second package.

23. The method of claim **22** further comprising replacing said depleted second package with a replenished second package.

24. The method of claim **13** further comprising connecting a leading end of said replenished second package with a trailing end of said replenished first package.

25. The method of claim **24** further comprising transferring delivery of said running length of stranded material across said stationary magazine frame to said replenished second package upon depletion of said replenished first package.

26. The method of claim **19** wherein said first removable cartridge supports a plurality of packages positioned adjacent one another and interconnected in series.

27. The method of claim **19** wherein said second removable cartridge supports a plurality of packages positioned adjacent one another and interconnected in series.

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